WHEELED SHOVEL

This application claims the benefit of priority from U.S. Provisional Patent Application Serial No. 60/539,066 filed on 26 January 2004.

FIELD OF INVENTION

[0001] The invention relates generally to manual wheeled vehicles for moving and disposing materials. More particularly, the present invention relates to a snow removal shovel on a wheel which provides a recoil action to assist in propelling the snow.

BACKGROUND OF INVENTION

[0002] Numerous manual wheeled vehicles have been in use to assist in transporting materials from one place to another. Age old wheelbarrow is, of course, well known. However, aside from transporting alone, loading onto and unloading of materials from a vehicle easily and with minimum stress and strain to the human body have required different approaches. This has been true for shoveling or plowing snow, including wet and heavy slushy snow.

[0003] In US Patent 5,918,921, Samuelson shows a levered shovel for moving snow. The shovel includes a blade for carrying the snow, a shaft that extends from the blade, a wheel assembly for contacting a horizontal surface and which depends from the shaft, and a handle assembly for gripping by the user and which is disposed on the rearmost end of the shaft. The wheel assembly comprises either an axle fork, an axle rotatively mounted to the axle fork, and a pair of wheels attached to the axle or an inverted T-shaped member with its transverse portion serving as its axle to which a pair of wheel are rotatively attached. The handle assembly comprises a lower transverse member for gripping by the hands of the user and extends laterally from both sides of the rearmost end of the shaft and an extender for elevating the point at which the user grips the handle assembly for users with limited bending posture.

[0004] Jurkowski, et al., disclose a wheeled snow shoveling device in US Patent 5,511,327. The shoveling device comprises a cart having a handle formed in a generally A-shaped configuration with a cross bar including a circular ring extending therefrom. The cart includes a wheel with an axle positioned at its axis, the wheel including a pair of vertical support bars affixed to the axle, the wheel also including a pair of horizontal braces affixed to its axle. The lower segment of the handle is coupled to the braces. A snow shovel has a blade formed as a generally rectangular shaped member and is molded into a semi circular configuration, the rear surface of the blade being coupled to the free ends of the horizontal braces of the cart wheel. The blade has a wooden shaft affixed to its rear surface, the shaft extending through the circular ring on the cross bar of the handle, the free ends of the vertical support bars being coupled to the shaft.

[0005] In another approach for removal of snow, Petruzzelli discloses in US Patent 6,675,507 an articulated shovel blade for pivoting movement relative to a wheeled carriage on which the blade is mounted. The shovel blade is adjustably locked in position at different angles relative to the direction of travel of the carriage, for pushing snow or other material to the side of the shovel as it travels across the ground. The carriage is pushed forward using a handle or a motor is provided for self-propelling the carriage.

[0006] In still another approach, Lobato describes in US Patent 5,581,915 a snowplow carriage assembly for removal of snow manually by plowing the snow in an area to be cleared of snow. The carriage is a manually propelled wheeled structure made of a plurality of members pivotally connected for collapsing and folding for storage and unfolding for use in supporting and transporting a snowplow in the form of a replaceable conventional snow shovel having a handle straight length portion. The carriage is configured so that the snow shovel handle is removably mounted thereon inclined from the horizontal defining an acute angle relative to a surface on which snow is being plowed. The snow shovel inclination is variable for establishing different acute angles of the shovel relative to the surface for plowing the snow thereon and removal therefrom.

[0007] In US Patent 6,643,958, Krejci discloses a snow throwing shovel device for removing snow from narrow sidewalks and from steps where a conventional snow blower cannot be used. The snow throwing shovel device includes

a scoop assembly including a housing having top, bottom, side, and back walls, and also having an open front. The shovel also includes an elongate chute attached to the scoop through which snow is moved. The shovel further includes a discharge spout rotatably mounted to the elongate chute, handle members attached to the elongate chute; and an assembly for picking up snow and moving snow through the elongate chute.

[0008] The present state of prior of art, thus, generally provides two types of shovels which are particularly common. One type involves lifting and throwing of the snow, and the other involves pushing of the snow like plowing. These cited prior art references are incorporated by reference in their entirety. What is needed is a combination of the two types of snow shovels where the plowing type of action can be incorporated into a shovel which also lifts and throws the snow with ease and with least ergonomical discomfort.

SUMMARY OF INVENTION

[0009] The present invention involves a wheeled shovel having a handle formed at the end of an elongate yoke, the yoke being mounted, near its middle portion, onto the axle of a relatively large wheel for the purposes of picking up of a load, transporting it to a destination, and propelling the load overboard with a quick body (or arm) motion on the part of a person operating the handle. The substantially waist-high wheel is adapted to receive the body force of an operator as an effective leverage through the handle and cause a recoil action from the wheel to enhance the throwing power of the apparatus of the invention, comprising the shovel, the wheel and the yoke as the driving member.

[0010] An embodiment of the present invention involves an apparatus for removing and disposing materials. The apparatus comprises a wheel assembly having a rim and an axle connected together with spokes radially projecting from the axle. The axle includes a fulcrum member capable of transmitting a recoil reaction to an action. A driving member has an upper portion, a middle portion and a lower portion. The middle portion is generally **S**-shaped and is attached to the fulcrum member of the axle. A handle is attached to the upper portion of the driving member and is capable of moving the wheel assembly. A blade is attached to the lower portion of the driving member, the blade being adapted to pick up a load of

material from a surface when the blade is lowered to the surface by raising the handle and pushing forward. When the handle is pushed downwards, the downward action causes the wheel to compress and recoil through the fulcrum member at the axle of the wheel. As a result, the blade springs upwards and forwards, thereby propelling the load of material briskly away from the apparatus

[0011] An aspect of the embodiment of the present invention comprises a wheel assembly having a rim and an axle, the axle further comprising a tubular body having two ends adapted to receive spokes which connect the axle to the rim. The axle further is adapted to receive a plurality of springs at the two respective ends of the axle to act as a fulcrum, and transmit a recoil reaction to an action applied at the axle. An elongate U-shaped driving member has a curved upper portion, a generally straight middle portion and an open lower portion. The middle portion is attached to the springs at each end of the axle. A handle forms the upper portion of the driving member, and is capable of moving the wheel assembly. A shovel blade attaches to the lower portion of the driving member, the shovel blade adapted to pick up material from a surface when the blade is lowered to the surface by raising the handle and pushing forward. The blade springs upwards and forwards, thereby releasing the material briskly away from the apparatus when the handle is pushed downwards to cause the springs to compress and recoil through the fulcrum member at the axle of the wheel.

[0012] Another embodiment of the present invention involves a method of method of snow removal using an apparatus comprising a relatively large wheel substantially at the waist level of an operator. A U-shaped yoke has a handle at a closed end, a shovel blade at an open end, and the yoke is mounted onto an axle of the wheel. The method involves an operator moving the apparatus along a path by pushing the handle and rolling the wheel in a direction commanded by the handle. The operator shoves onto the blade a load of material along the path of the apparatus. After picking up the load of material, the operator presses the handle downwards, to lift the shovel blade to a level that clears the path; adjusts further the level of the shovel blade to achieve a balanced load with respect to and over the axle of the wheel; transports the balanced load of material to a destination; and at destination, briskly applies body weight at the handle to propel the load of material to a substantial distance away from the apparatus.

BRIEF DESCRIPTION OF DRAWINGS

[0013] ***Figure 1*** is a three-dimensional embodiment of the apparatus of the present invention showing a relatively large wheel incorporated to a driving member in the shape of a yoke, the yoke having a handle at one end and a shovel blade at the other, for picking up, transporting and disposing materials in general, and snow in particular, according to the present invention.

[0014] ***Figure 2*** is a top view of the apparatus of ***Figure 1***, showing the placement of the shovel and wheel within the yoke, according to the present invention.

[0015] ***Figure 3*** is a side view of the apparatus of ***Figure 2***, showing an aspect of the adjustability of the handle of the apparatus, according to the present invention.

[0016] ***Figure 4*** is a schematic drawing of the apparatus of ***Figure 3*** showing the various dimensional relationships of the components of the apparatus of the present invention.

[0017] ***Figure 5*** is another schematic drawing of the apparatus of ***Figure 3*** showing the various forces acting at the fulcrum of the apparatus, according to the present invention.

[0018] ***Figure 6*** is a schematic drawing of an embodiment of the present invention showing the yoke having an **S**-shaped middle portion and a handle which is rotatable and slideably extendable.

[0019] ***Figure 7*** is a schematic drawing of an aspect of the present invention involving springs as an assist in propelling materials from the shovel blade, according to the present invention.

[0020] ***Figure 8*** is a schematic drawing of an aspect of an embodiment of the present invention showing blade rollers employed for ease of travel of the blade over rough ground, such as gravel surface, according to the present invention.

DETAILED DESCRIPTION

[0021] Referring now to the drawings, *Figures 1-8,* there are shown embodiments of the present invention involving the pick up, transport and disposal of materials in an efficient and effective manner.

[0022] Reference numeral **10** in ***Figure 1*** generally refers to an apparatus representing an embodiment of the present invention comprising a wheel assembly **100**, a driving member **110**, resembling substantially a U-shaped yoke having a handle **133** at its closed and a shovel blade **120** attached to its open end, wherein the yoke is mounted onto axle **190** of the wheel. The wheel and the blade are incorporated into the driving member in a manner that the blade rests on the ground in its normal position. An operator uses the handle to move the shovel in any direction by rolling the wheel on the ground. The operator also uses the handle to guide the shovel in shoving into the blade material lying along its path. The operator then lifts the shovel blade off the ground to pick up a load of material, followed by further lifting to balance the load at a comfortable walking posture. At destination, the operator presses on the handle with a quick downward body (or arm) motion, to propel the load away from the shovel. The operator can dispose the material either straight ahead by directing the shovel in the direction of the motion of the apparatus, or to the side by flipping the shovel sideways.

[0023] It will be appreciated by those skilled in the art and by ordinary users of snow shovels that the large wheel **100** shown in ***Figure 1*** (as further defined below and depicted in *Fig. 3* relative to human dimensions) enables a user to lift snow and blade above unshoveled snow height and travel over it and rough surface without compressing unshoveled area to be traversed. The relatively high level handle of the shovel enables the user to comfortably accelerate forward the load of snow off the blade while pushing down the handle, which enhances the throw distance of the snow trajectory.

[0024] The wheel assembly **100**, driving member **110** and shovel **120** are formed ergonomically to assist in picking up and releasing a heap of material **160**, such as sand, gravel or snow, generally aligned in the direction of motion, with least stress to the body of the operator, and especially to prevent back stress or injury. As will be explained more in detail later in an embodiment of the present invention, a recoil assist is provided to the action of the operator of the apparatus

from a fulcrum area of the apparatus to release the material in a brisk and efficient manner. The material can also be picked up and released while the wheel is stationary. Furthermore, the material can be throwingly released, or propelled, forward or sideways, as desired, while the wheel is stationary or in motion.

[0025] In an embodiment of the present invention shown in ***Figure 1***, driving member **110** is formed preferably of continuous metal tubing that is shaped to have a handle **133** in its upper portion **130**, a fulcrum bearing area **145** in middle portion **140** and an open frame **155** in the lower portion **150** to accept blade **120**. Handle **133** is extendable at **115** to permit length, height and leverage adjustments, as will be described in more detail later in the various embodiments of the present invention. Fulcrum bearing area **145** shown in the same ***Figure 1*** comprises an opening in the middle portion **140** of the driving member, preferably capable of receiving a roller bearing (not shown). A portion **195** of axle **190** of the wheel assembly **100** fits inside the fulcrum area **145** of the driving member. The attachment point at **145** is designed to reconfigure the shovel for user height, strength and snow conditions. An attachment that can slide along the middle portion of the driving member can be used to adjust the height of the handle for leverage as well as for ease of operation of the apparatus. Aspects of the function of the fulcrum, and attachments thereto, will be explained in more detail below with respect to the relationship of the fulcrum to the handle and the shovel for disposing of materials from the shovel in a brisk, and yet ergonomically advantageous manner.

[0026] In an aspect of the embodiment shown in ***Figure 1***, the driving member **110** is formed in an elongate U-shape, resembling a yoke, with an upper portion providing the handle **133**, and a narrowed middle portion **140** with distal sides to accommodate the axle **125** of the wheel assembly **100**. The distance between the relatively long legs (encompassing generally the middle portion **140**) of the U-shaped driving member **110** is determined by braces **117**, **119** and **157** formed judiciously between the legs so that the axle fits in the fulcrum areas **145**. It will be known to those skilled in the art that any number of different ways can be employed to attach the axle of the wheel in the openings forming the fulcrum areas **145**. For example, the well-known quick release for bicycle wheels can be employed. Or, the axle, in the form of a tube having protrusions **195** with inside shoulders (not shown) can be snapped into openings **145** by gently spreading apart the legs **140** of the U-shaped driving member. These wheel mounting features are

well known in the art and as they are not significant to the invention, they are not described in detail here in order not to unnecessarily obscure the present invention. It is preferred that the tubing material for the driving member **110** comprises hollow aluminum, or other metal tubing. Non-metal materials, such as plastics may also be used.

[0027] In another aspect of an embodiment of the present invention, wheel assembly **100** comprises a wheel **170**, a rim **175** and spokes **180** which connect the axle **190** to rim **175**, as shown in ***Figure 1*** and in top view of ***Figure 2***. Different types of wheels, including different treads, widths or a continuous web connecting the axle to the rim can also be used. Relatively narrow wheels, such as shown in ***Figure 1***, provide the advantage of not packing down snow, for example, when shoveling snow. The dimensions of wheel **170** and the position of handle **133** relative to axle **190** of the wheel are determined generally with respect to the position of the arms of a human body. A relative position of handle **133** with respect to a general body posture is shown in ***Figure 3***.

[0028] In still another aspect of an embodiment of the present invention shown in ***Figure 4***, it is preferred that the wheel diameter **a** is between about 30 to 36 inches, while the height of handle **110** from a datum plane directly under the wheel, that is, from a ground datum **x**, is between about 48 to 60 inches. The height of handle **133** from the center of axle **195** is preferably between about 26 to 42 inches. In another aspect of the present invention, further adjustment of the height of the handle is provided by a telescoping means **115**, such as a sliding hollow outer tube over an inner tube as shown in ***Figure 3***, which ensures better ergonomic comfort. The over-all length **d** of the wheeled shovel is between about 78 to 88 inches. Distance **e** from the tip of the shovel blade **120** to the fulcrum area **145** near the center of the wheel assembly **100** is between about 32 to 42 inches. Distance **f** from the fulcrum area to the tip of the handle shown in ***Figure 4*** can be varied depending upon the preferences on the part of the operator. For example, distance **f** can be adjusted to make it easier to pick up and lift a load, balance the load on the apparatus more evenly for ease of transport to a location, and/or to gain more leverage in shoving the load from the shovel at the location of interest.

[0029] Thus, it will be apparent to those skilled in the art that the relationship between the relatively large diameter of the wheel, over-all length of the

shovel and the height of the shovel handle from the ground determine the ease with which snow may be shoveled. The chest-high position of the handle assists in pushing the accumulated snow or other material that is being shoveled. A ratio grater than 1:1 between the length of the yoke and the height of the handle provides the ease with which a blade full of snow can be lifted as the handle is lowered. This leverage ratio can be varied by varying the point at which the yoke connects to the axle. Furthermore, differently shaped yokes, such as shown in *Figures 4 and 5,* contribute differently to the efficiency of the shovel. A preferred **S**-shaped yoke is shown in ***Figure 6***, and will be described in more detail later in the preferred embodiments of the present invention.

[0030] In addition to the ergonomic advantages, the embodiments of the present invention provide enhanced functional performance through a judicious use of a fulcrum line formed at the central portion of the wheel assembly shown in ***Figure 5***. Line **x'** passing through the center of the fulcrum area **145** parallel to the ground datum line **x** forms the fulcrum line. A force **F** applied to the fulcrum through an action at the handle **133** can be resolved into a horizontal component $\mathbf{F_h}$ and a downward vertical component $\mathbf{F_v}$, as shown in ***Figure 5***. With no substantial resistance to the horizontal component $\mathbf{F_h}$, the wheel rolls to the left, in accordance with the direction of the applied force **F** shown in ***Figure 5***, while the ground under the wheel reacts to the downward component $\mathbf{F_v}$ giving rise to an upward recoil reaction $\mathbf{-F_v}$ by the wheel. A brisk and mostly downward action on the handle, using arm and/or body weight, for example, produces a recoil assist to the throwing power. The magnitudes of the component vectors are determined by angle $\boldsymbol{\beta}$, of the transmittal force **F** substantially by angle $\boldsymbol{\theta}$. Angle $\boldsymbol{\Omega}$ contributes to the throwing power. Furthermore, the shovel blade can be formed in different configurations to assist in efficient release of material **160** from the shovel. For example, the shovel blade can have a bottom portion with a relatively large radius of curvature $\boldsymbol{\rho}$, resembling a scoop, for easy slide of material from the shovel, as well as for keeping the material from sliding backwards and spilling off the shovel. It will be appreciated by those skilled in the art that that these various parameters can be set to values that are commensurate with the ergonomic and functional requirements of the apparatus of the present invention.

[0031] ***Figure 6*** illustrates a preferred embodiment of the invention with similar characters and numerals referring to similar parts throughout the several

views. The side-view of the yoke shown in ***Figure 6*** has an upper portion **130,** middle portion **140** and a lower portion **150.** The yoke is attached to wheel **170** (shown in phantom) at its axle **195** (not shown) in a notch **O** of a slideable sleeve **143.** Sleeve **143** can be slid (in the direction of either one of the arrows shown in the same figure) over portion **150** of the yoke to change the position of fulcrum **145,** the effective leverage length **f** and the "throw arm" **e.** The throw is accomplished by pushing handle **133** in a downward direction to the phantom position **133'.** The primed reference numerals, namely, **130', 135', 140', 150'** and **120',** show other parts of the yoke, including the shovel blade, in a position following the downward motion of the handle of the yoke. It will be understood by those skilled in the art that various different mechanisms can be used to adjust the fulcrum point to achieve the desired leverage for throwing the load off the shovel.

[0032] An aspect of an embodiment of the present invention involves an **S**-curved section forming the middle portion **140** of the yoke shown in ***Figure 6.*** The substantially "**S**" curve (including the substantially straight section in the middle portion of the curve) is integral to optimizing "gearing"/leveraging in order to enhance the acceleration of the blade and throwing of the load faster, higher and farther from the shovel. The "**S**" shape is formed to have the lower curve, subtending angle **ϕ**, start relatively close to the axle; preferably at a distance **W** between about 4 to 6 inches from the axle near fulcrum area **145.** Angle **ϕ** of the lower portion of the **S**-curve and angle **ϕ'** of the upper portion, as shown in ***Figure 6,*** are both preferred to be between about 80° and 90°, though it will be appreciated that other angles may also be used. Thus, as handle **133** is lowered, the elbow of the lower portion of the **S**-curve travels a distance **A** through arcs **Σ_1** and **Σ_2,** as shown in the same ***Figure 6.*** The straight portion of the **S**-curve traverses the arcs **Δ_1** and **Δ_2.** As the handle is lowered, the **S**-curve starts moving downward and the handle thus only needs to be lowered an amount equal to **T** in order to lift blade **120** to height **M** in new position **120'.** It is an aspect of the present invention that, as the middle portion **140** comprising the **S**-curve, including the straight section, is positioned closer to the fulcrum area **145,** the magnitude of **A** and leverage ratio **M/T** (the ratio of blade lift to handle movement) are varied accordingly. It is preferred that the length **H** of the straight section of the **S**-curve is greater than **A** so that throughout the entire range of handle motion, the desired leverage (based on axle attachment point) or "gearing", is maintained as the blade is raised and

lowered. Thus, for optimal operation (i.e., comfortably, and without bending on the part of the operator of the shovel) it is preferred that the maximum travel **T** of handle $T>H>A$, $\Delta_1 \approx \Delta_2$, and $\Sigma_1 \approx \Sigma_2$.

[0033] In another aspect of the present invention, the handle portion **133** shown in ***Figure 6*** has a shank **134**, which slideably and rotatably fits inside hollow sleeve section **135**. Handle **133** can be pulled out, pushed in and/or rotated in order to find the most ergonomic position for shoving, picking up and throwing a load from the shovel. Shank **134** can be slid to any one of continuous positions along sleeve **135** by utilizing friction hold against the inside surface of the hollow sleeve **135**. However, pins **137** are preferred which engage holes **139** judiciously placed along the length of section **135**. Length **E** along handle **133** is between about 12 to 18 inches, while length **L** along section **135** is between about 16 to 24 inches, although other lengths can also be used. The over-all length **d** of the shovel apparatus can be increased by Δ_d , preferably between about 6 to 12 inches, while the over-all height **c** can be increased by Δ_c, preferably between about 4 to 8 inches, thus yielding an over-all length **G** between about 89 to 100 inches and over-all height **I** between about 42 to 66 inches. With the preferred dimensions cited here, the shovel blade can be comfortably raised to a height between about 36 to 44 inches.

[0034] In another aspect of the present invention, a plurality of springs **200** (only one shown in the side view in ***Figure 7***) are utilized to provide an enhanced recoil reaction at the fulcrum line when the tire used for the wheel **170** is not as flexible as for example, a bicycle tire with a pneumatic tube. In ***Figure 7***, axle **190** is adapted to receive one spring at each of the two respective ends **195** of the axle which act as a fulcrum and transmit a recoil reaction to shovel blade from an action applied at the axle.

[0035] In still another aspect of the present invention, rollers **210** are attached to the bottom of shovel blade **120** for ease of traversing over rough ground surface **220**, such as gravel, as shown in ***Figure 8***. It will be obvious to those skilled in the art that rollers will also reduce friction with the ground, especially as more load accumulates on the shovel while the shovel is being pushed forward to pick up more material, such as snow, from the ground. Similar rollers with similar reference numerals are shown in ***Figure 6*** where the primed numeral corresponds

to the position of the rollers when shovel **120** is elevated. As seen in ***Figure 6***, the shovel to which the roller is attached has a lateral dimension **P** between about 15 to 18 inches.

[0036] The embodiments of the present invention shown in ***Figures 1-8*** are adaptable for various enhancements and improvements in useful ways. For example, a shovel blade may be designed with a more flexible material to enhance the ability to throw the shovel load. The flexibility of the blade would provide a trampoline effect as the blades flexes back to its original shape from a bent shape as it accelerates to unload the load. A comparable effect is obtained by attaching the shovel blade to the shovel yoke with a spring-loaded hinge (not shown) that enhances the throwing capacity of the wheeled shovel. Furthermore, shovel blade **120** is fitted with side walls **125** as shown in ***Figure 3*** in order to be able to pick up and retain liquid like substances, such as snow slush. In another aspect, the driving member, resembling a yoke, is made to fold at the fulcrum area where a quick release wheel is mounted and removed readily for ease of transporting the apparatus. As an alternative, the driving member comprises two halves (not shown) attached to each other at the fulcrum area **145** of ***Figure 1***. It will also be understood that a plurality of wheels of various widths can be used instead of the one wheel shown in ***Figures 1-8*** of the present invention. Further, the apparatus can be motorized to pick up, transport and propel a load of material from the wheeled shovel of the present invention. Also, motor energy can be utilized to store energy in a spring or in other energy storing device, which in turn can be used on demand to assist in pushing and/or throwing the load on the shovel.

[0037] Though these numerous details of the disclosed apparatus and method are set forth here, such as the various dimensions, to provide an understanding of the present invention, it will be obvious, however, to those skilled in the art that these specific details need not be employed to practice the present invention. That is, while the invention has been particularly shown and described with reference to the embodiments thereof, it will be understood by those skilled in the art that various changes in form and details may be made without departing from the spirit and scope of the invention.